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ABSTRACT

Two experiments were conducted to assess the effects of elaborated presentation on noun-pair retention. A 2 x 2 factorial design was used with aural-verbal presentation (standard versus elaborated) and visual-pictorial presentation (standard versus elaborated). Subjects for one experiment were 64 second-grade children from a Mexican-American population of low socioeconomic status; those for the second experiment were 64 second-grade children from a white population of middle socioeconomic status. Subjects in both experiments learned 20 word-pairs by the study-test, paired-associate method. Retention was tested after a seven-day interval by the cued-recall method. Analyses of results indicated that aural-verbal and visual-pictorial elaboration facilitated the initial acquisition of noun pairs but did not influence long-term retention when the degree of original learning was equated. (Author/AA)

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Aural-Verbal and Visual-Pictorial Elaboration Effects on Children's Long Term Memory for Noun Pairs

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Running head: Elaboration Effects on Children's Long Term Memory

Abstract

Two experiments were conducted to assess the effects of elaborated presentation on noun-pair retention. The basic design of each experiment consisted of a 2 x 2 factorial with aural-verbal presentation (standard versus elaborated) and visual-pictorial presentation (standard versus elaborated). Experiment 1 was conducted with sixty-four second grade children drawn from a low socio-economic status Mexican-American population while Experiment 2 was conducted with sixty-four second grade children selected from a middle socio-economic status white population. Subjects in both experiments learned the same twenty pair list of nouns to a criterion of 16/20 correct by the study-test paired-associate method. Retention was tested after a seven day interval by the cued recall method. The results indicated that elaborated presentation facilitated the initial acquisition of noun pairs in both experiments. In addition, significant retention benefits were also associated with elaborated presentation in the first experiment. These estimates of elaborative retention effects, however, were beclouded by minor variation in the levels of original learning between presentation conditions. Experiment 2 provided the more decisive estimate of elaborated presentation effects on retention because unequivocal control over the terminal levels of acquisition was achieved. The retention analysis in this experiment indicated that elaborated presentation neither helped nor hindered the retention of noun-pairs. The results of this study suggest that aural-verbal and visual-pictorial elaboration may be added to the list

of factors which have a potent effect on acquisition, but do not influence long term retention when the degree of original learning is equated.

Aural-Verbal and Visual-Pictorial Elaboration Effects on Children's Long Term Memory for Noun Pairs

In children's paired-associate learning of noun pairs, a comparison is frequently made between standard and elaborated presentation. This comparison can be made in either the aural-verbal or visual-pictorial mode. In the aural-verbal mode, standard presentation consists of presenting the to-be-remembered (TBR) nouns alone (e.g., the chain--the bowl) or connected by a conjunction (e.g., the chain and the bowl), while elaborated presentation consists of presenting the nouns connected by a preposition or verb (e.g., the chain inside the bowl). Standard presentation in the visual-pictorial mode consists of depicting the referents of the TBR nouns side by side, while elaborated presentation consists of depicting the referents engaged in a spatial interaction (e.g., a picture of a chain sitting inside a bowl). The usual outcome of such comparisons is that elaborated presentation is associated with improved paired-associate learning relative to standard presentation (Davidson & Adams, 1970; Kee, 1976; Kee & Rohwer, 1973, 1974; Rohwer, Kee, & Guy, 1975).

Current theory (cf. Anderson & Bower, 1973; Paivio, 1970; Rohwer, 1973) suggests that elaborated presentation prompts the encoding of shared referential meaning for the otherwise disparate pair members. The memory unit for pairs encoded in this manner is held to be more cohesive, thereby increasing pair member availability relative to pairs encoded under standard presentation. Research has focused primarily on the short term benefits of this type of coding. An impressive number of task and subject conditions have been surveyed.

The literature consistently demonstrates elaborated presentation effects on the initial acquisition of noun pairs (cf., Rohwer, 1973). Research concerning the long term benefits of elaborative coding has been minimal. Thus, the purpose of this study is to provide evidence on the problem. The question of interest is this: Will elaborated presentation have an effect on retention? That is will subjects who learn noun pairs under elaborated presentation remember the pairs any better (or worse) than subjects who have learned the identical pairs to the same degree, but under standard presentation.

Some previous research suggests that elaborated presentation is associated with less forgetting after retention intervals of forty-eight hours (Rohwer, Ammon, Suzuki, & Levin, 1971) and one week (Kerst & Levin, 1973). These findings are not conclusive however, because in these studies degree of learning for the conditions was not equated prior to the retention interval (cf. Underwood, 1964). Therefore, the retention effects observed may have simply reflected differences in the number of items initially acquired, rather than differential forgetting.

Original learning was nominally equated in a study by Reese and Parkington (1973) which assessed the effects of visual-pictorial elaborated presentation on the seven day retention of noun pairs with four and five year old children. In order to equate original learning, the children were required to learn the paired-associate list to a 100% performance criterion by the multichoice test procedure. Some retention benefits were observed for elaborated presentation. However, their results may

also be inconclusive. One problem is that on the criterion trial, the multichoice test procedure can differentially effect the associative strength of pairs by serving as an extra study trial (cf. Postman, Jenkins, & Postman, 1948). A second problem is that requiring subjects to reach a 100% performance criterion precludes the assessment of variation in strength at the conclusion of acquisition, hence, it is not possible to determine if the degree of original learning between experimental conditions was adequately controlled. In the present study, testing was conducted by the cued recall method. This procedure is less likely to serve as an extra study trial in acquisition. In addition, subjects were required to reach an 80% performance criterion prior to the retention interval. Assessment of the number of correct associations given on the criterion trial of acquisition will provide an assessment of the levels of learning actually achieved in the different conditions prior to the retention interval.

A final study by Olton (1969) deserves recognition. Olton assessed the effects of pre-exposure of nouns embedded within a printed sentence context on the seven day retention of fifth grade children. Original learning was controlled by requiring subjects in the different pre-exposure conditions (e.g., elaborated versus standard) to learn the list to a pre-determined number of trials. His results indicated that while pre-exposure to printed verbal elaboration facilitated original learning, no difference in retention was observed on a seven day retention test between the elaborated and standard presentation. The assessment of elaborated presentation effects on retention in the present study will serve to extend Olton's analysis of verbal elabor-

ated presentation to the aural mode. In addition, provisions were made to provide a direct comparison between the two methods of elaborated presentation frequently used to facilitate paired-associate learning in childhood: Aural-verbal and visual-pictural.

Experiment 1

Method

Design and Subjects. The basic design of the experiment consisted of a 2 x 2 factorial with aural-verbal presentation (standard versus elaborated) and visual-pictorial presentation (standard versus elaborated). Subjects participated in two experimental sessions: (1) acquisition, and (2) retention. This basic 2 x 2 design was augmented in the retention phase of the experiment to include the within subject factor of trials (one to three).

Subjects in the experiment were sixty-four second grade children. Their modal age was seven years. The children attended school and resided in a low socio-economic status Mexican-American community in Los Angeles, California. Census tract data revealed that the median educational level of this community was 7.9 years and the median income was $5,467. All of the participating children had Spanish Surnames and were selected from bilingual classrooms.

Materials and Procedures. A twenty pair list of common nouns was used (e.g., cow-tie, ship-buggy, etc.). Line drawings of the noun referents were prepared and photographed onto 35-mm slide transparancies. Standard aural-verbal presentation consisted of the presentation of the noun labels connected by a conjuction (e.g., the chain and the bowl), while elaborated aural-verbal presentation con-

sisted of the noun labels connected by a preposition (e.g. the chain inside the bowl). Standard visual-pictorial presentation consisted of the depiction of the noun referents side by side, while elaborated visual-pictorial presentation consisted of the depiction of the object referents engaged in a spatial interaction (e.g. a picture of a chain inside a bowl). A total of nine random orders of the list were constructed. An arrangement of six of these orders was used in the acquisition phase of the experiment which allowed for three alternating cycles of study and test. The final three list orders were used for test trials in the retention phase.

Subjects were tested individually in a room at the participating school. Testing was conducted by a Mexican-American female. Subjects were seated at a small table on which a side screen projection unit was located. A study-test paired-associate procedure was used during acquisition. The subject was informed that twenty pairs of nouns would be presented and that (s)he should learn them in such a way so as to be able to produce the name of one member of the pair when presented with the other. Visual-pictorial presentation was made by 35-mm Kodak slide prjector. The rate of presentation on study trials was four seconds per pair. As each pair was presented visually the experimenter labeled the referents in an appropriate manner (i.e., standard or elaborated). The test trial rate was also four seconds per pair. On the test trial the subject was presented with one member from each pair and was asked to verbally recall the associate. Subjects were required to learn the pairs to a criterion of 16/20 correct in the acquisition phase. A strict scoring procedure was used in which

only responses which matched experimenter provided labels were accepted as correct. This provision was made in order to standardize the establishment of criterion performance across subjects. It will be recalled that in the construction of the paired-associate lists for acquisition, provisions were made for three alternating cycles of study and test. If a subject required additional practice to reach criterion, the set of three study-test trials was recycled in sequence.

Subjects were required to return after seven days for the retention test. This test consisted of three cued recall trials. Stimulus cue presentation was both aural-verbal and visual-pictorial. The test trial rate was subject paced; however, if the subject failed to provide a response within ten seconds, the stimulus cue was advanced.

Results and Discussion

The results will be reported in two parts: (1) acquisition, and (2) retention. Unless specified otherwise, the type 1 error rate for tests was set equal to .05.

Acquisition. Table 1 presents the mean number of trials to cri-

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Insert Table 1 about here

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terion as a function of aural-verbal and visual-pictorial presentation. Analysis of variance indicated that the target phenomena of interest were replicated: Both aural-verbal and visual-pictorial elaborated presentation improved the acquisition of noun pairs, $F(1,60) = 5.56$; $F(1,60) = 22.98$, respectively. The interaction between the two factors was also significant, $F(1,60) = 7.09$. The form of the interaction

suggests that the effects of aural-verbal and visual-pictorial elaborated presentation were not additive.

In order to equate the degree of learning between the different presentation conditions prior to the retention interval subjects were required to reach a criterion of 16/20 correct. Assessment of the number correct on the criterion trial indicates whether original learning was successfully controlled. Table 2 presents the mean number

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Insert Table 2 about here

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of correct responses on the criterion trial as a function of aural-verbal and visual-pictorial presentation. Analysis of variance failed to detect any reliable source of variance.

Retention. Both strict and lenient scoring procedures were used to tally responses on the retention test trials. The strict procedure counted correct only those responses which were identical to the labels provided by the experimenter in acquisition, while the lenient procedure also accepted synonyms and Spanish equivalents. Loss scores were computed for both scoring indicies. A loss score provides a sensitive measure of forgetting, representing the number correct on the criterion trial minus the number correct on the retention test. A preliminary analysis indicated that the loss scores based on the strict and lenient retention test scoring produced identical patterns of performance across the experimental conditions. Thus, only the analysis of loss scores based on the strict retention test scoring will be reported in order to maintain congruence with the dependent

variable used to assess acquisition.

The mean loss scores as a function of aural-verbal and visual-pictorial presentation, collapsed over trials, are presented in Table 3. A repeated measures analysis of variance indicated a significant

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Insert Table 3 about here

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aural-verbal presentation effect, $F(1,60) = 4.21$, such that elaborated aural-verbal presentation was associated with less forgetting than standard aural-verbal presentation. A significant visual-pictorial presentation effect was also detected, $F(1,60) = 4.36$, indicating that elaborated visual-pictorial presentation was associated with less forgetting than the standard visual-pictorial presentation. A significant trials effect was observed, $F(2,120) = 3.91$, which indicated that the number of items lost declined over the three retention test trials (6.72, 6.52, 6.16). The only other significant effect was an aural-verbal x visual-pictorial x trials interaction, $F(2,120) = 9.07$. The form of this three-way interaction suggests that the influence of aural-verbal and visual-pictorial elaborated presentation were only additive on the last two retention test trials.

The present outcome suggests that both aural-verbal and visual-pictorial elaboration benefits not only the initial acquisition of noun pairs, but their retention as well. This finding is contrary to the results reported by Olton for printed-verbal elaboration. Moreover, the learning and memory literature generally indicates that when the degree of original learning is equated, a number of potent learning

variables such as meaningfulness (Underwood & Richardson, 1956), learning ability (Shuell & Keppel, 1970) and imagery instructions (Hasher, Riebman, & Wren, 1976) have little or no effect on long term memory. Thus, the results of the present experiment may provide the first evidence of a potent learning variable which favorably affects both acquisition and retention. This conclusion, however, may be premature. It will be recalled that the subjects were required to learn the paired-associates to a criterion of 16/20 correct at acquisition. A strict scoring procedure was used which counted correct only those responses which matched the experimenter provided labels. An examination of the score sheets indicated that 56% of the children provided at least one response in Spanish on the criterion trial. A rescoring of criterion trial performance was conducted which accepted both Spanish equivalents and synonyms as correct in order to determine if original learning was controlled under a more sensitive index of the number of pairs acquired. An analysis of variance was conducted and revealed no significant effects at the traditional .05 alpha level. Differences, however, were detected at the .10 alpha level suggesting that more correct pairs were acquired under the elaborated conditions. An additional retention analysis was conducted based on loss scores computed from the number correct on the criterion trial (lenient scoring) minus the number correct on each retention test trial (lenient scoring). This analysis revealed the same pattern of elaboration benefits in retention as previously reported.

Experiment 2

The estimates of elaborative retention effects in the first experiment may have been mitigated by variation in original learning between the different presentation conditions. Therefore, a second experiment was conducted in order to provide a more decisive assessment. Subjects in this experiment were drawn from a population of middle socio-economic status white children. This population offers two advantages relative to the population sampled in the first experiment: (1) It is directly comparable to the target populations sampled in most of the previous paired-associate learning studies concerned with elaboration effects, and (2) the difficulty previously encountered with the scoring procedure used to establish criterion performance for subjects is absent because the population is primarily monolingual.

Method

Design and Subjects. The basic design of the experiment consisted of a 2 x 2 x 2 factorial with aural-verbal presentation (standard versus elaborated), visual-pictorial presentation (standard versus elaborated) and subject's sex (male and female). This design was augmented to include the within subject factor of trials (one to three) in the retention phase of the experiment.

Subjects in the experiment were sixty-four second grade children. Their modal age was seven years. The children attended school and and resided in a middle-class white community neighboring Los Angeles, California. Census tract information indicated that the children's community had a median educational level of 13.8 years and a median income in excess of $18,000.

Materials and Procedures. The methods and procedures are identical to those used in the first experiment with the following exceptions: (1) Aural-verbal presentation was made by audio-cassette recorder (Wollensack #2551) sychronized with the 35-mm slide projector, and (2) the experimenter was a white female.

Results and Discussion

Similar to Experiment 1, the results are reported in two parts: (1) Acquisition, and (2) retention. The type I error rate was also set at .05, except where otherwise indicated.

Acquisition. Table 4 presents the mean number of trials to criterion as a function of aural-verbal and visual-pictorial presentation. As can be seen, both aural-verbal and visual-pictorial elaborated presentation facilitated noun-pair learning, $F(1,56) = 19.17$; $F(1,56) = 16.66$, respectively. The interaction between the two factors was also significant, $F(1,56) = 9.26$. The form of the interaction suggests that the benefits associated with aural-verbal and visual-pictorial elaborated presentation were not additive. No other source of variance was significant.

Insert Table 4 about here

Criterion trial performance was assessed in order to determine if original learning was successfully equated prior to the retention interval. Both a strict and lenient scoring of criterion trial performance was made. A preliminary analysis indicated that the two measures produced identical patterns of performance across the experi-

mental conditions. Thus, only the analysis of the lenient scoring procedure will be treated because it affords the more sensitive index of the number of pairs acquired. The means for the number of correct responses given on the criterion trial as a function of aural-verbal and visual-pictorial presentation are presented in Table 5. As can

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Insert Table 5 about here

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be seen, the conditions are equivalent. Analysis of variance failed to detect any reliable source of variance, $p > .10$.

Retention. Loss scores were computed for each subject based on the number correct on the criterion trial (lenient scoring) minus the number correct on each of the retention test trials (lenient scoring). The means for the conditions collapsed over the factors of subject's sex and trials are presented in Table 6.

Insert Table 6 about here

Analysis of variance with repeated measures revealed that aural-verbal and visual-pictorial presentation, and the interaction between these two factors were not associated with significant effects: $F(1,56) = 1.47$; $F(1,56) = .98$; $F(1,56) = 1.21$, respectively. This outcome indicates that neither of the methods of elaborated presentation (i.e. aural-verbal or visual-pictorial) which customarily facilitate noun-pair learning have an effect on the long term retention of noun pairs when the degree of original learning is equated.

Only two sources of significant effects were detected in the analysis of loss scores. A trials effect was observed, $F(2,112) = 21.07$, which indicated that the number of items lost declined over the three test trials (4.92, 4.31, 4.11). This finding suggests that the context of original learning may have been reinstated by the repeated testing, thereby increasing the probability of correct response selection and retrieval. Finally, a four-way interaction was observed between the factors of aural-verbal presentation, visual-pictorial presentation, subject's sex, and trials, $F(2,112) = 3.92$. The form of this interaction, however, did not serve to qualify previous conclusions drawn about the effects of aural-verbal and visual-pictorial presentation, hence, it will not be treated in further detail.

Both extralist and within-list intrusions were tabulated. The rate of extralist intrusions was extremely low ($M = .30$ of an item). Analysis of variance failed to detect any reliable source of variance. The mean rate of within-list intrusions was 1.73 of an item. Analysis of variance revealed only one significant effect: Trials, $F(2,112) = 3.88$. This effect indicates that the number of within-list intrusions declined over the three test trials (2.03, 1.69, 1.47). This outcome is consistent with the notion that repeated testing in the retention phase served to reinstate the context of original learning. Thus, the number of misplaced responses (i.e. within list intrusions) would be expected to decline as the subject became more accurate at correct response selection and retrieval.

General Discussion

The present investigation was conducted to determine the effects of aural-verbal and visual-pictorial elaborated presentation on the long term retention of noun pairs. The estimates of elaborative retention effects in the first experiment are beclouded by a minor variation in the degree of original learning between the presentation conditions. Thus, the retention benefits observed as a function of aural-verbal and visual-pictorial elaborated presentation probably reflect differences in the terminal levels of learning achieved in acquisition as opposed to differential forgetting. The estimates of retention effects in the second experiment are more decisive because unequivocal control over the degree of learning was obtained between conditions prior to the retention interval. The findings from this experiment clearly indicate that while elaborated presentation facilitates the initial acquisition of noun pairs, it neither helps nor hinders their long term retention.

A conclusion that would apply to the present results and those of previous investigations concerned with the effects of potent learning variables on retention is this: It is not the manner in which items are acquired which primarily influence long term retention, but rather how well these items are originally learned. An alternative way to view the present outcome is in terms of "cost effectiveness." That is, to sustain the same level of retention after seven days, elaborated presentation requires only half as many study-test cycles as standard presentation. This latter view serves to underscore the role of elaboration as a "facilitator" in childhood even in the absences of a direct retention effect.

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Footnotes

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A version of this paper titled "Children's Long Term Memory for Noun Pairs: Assessment of Elaboration Effects in Different Populations," was presented at the Annual Meeting of the American Educational Research Association, New York 1977. Request for reprints should be addressed to Daniel W. Kee, Department of Psychology, University of Southern California, University Park, Los Angeles, California, 90007.

Table 1

Experiment 1: Mean Number of Trials to Criterion as a Function Aural-Verbal and Visual-Pictorial Presentation

Visual-Pictorial Presentation	Aural-Verbal Presentation		
	Standard	Elaborated	M
Standard	5.69	3.63	4.66
Elaborated	2.63	2.75	2.69
M	4.16	3.19	

Note: MS_e (60) = 2.70

Table 2

Experiment 1: Mean Number Correct on the Criterion Trial as a Function of Aural-Verbal and Visual-Pictorial Presentation

Visual-Pictorial Presentation	Aural-Verbal Presentation		
	Standard	Elaborated	M
Standard	16.81	16.75	16.78
Elaborated	17.19	17.31	17.25
M	17.00	17.03	

Note: MS_e (60) = 1.22

Table 3

Experiment 1: Mean Loss Scores as a Function of Aural-Verbal and Visual-Pictorial Presentation

Visual-Pictorial Presentation	Aural-Verbal Presentation		
	Standard	Elaborated	M
Standard	7.77	6.38	7.08
Elaborated	6.35	5.35	5.85
M	7.06	5.87	

Note: MS_e (60) = 16.36

Table 4

Experiment 2: Mean Number of Trials to Criterion as a Function of Aural-Verbal and Visual-Pictorial Presentation

Visual-Pictorial Presentation	Aural-Verbal Presentation		
	Standard	Elaborated	M
Standard	6.13	3.00	4.57
Elaborated	3.13	2.56	2.85
M	4.63	2.78	

Note: MS_e (56) = 2.84

Table 5

Experiment 2: Mean Number Correct on the Criterion Trial as a Function of Aural-Verbal and Visual-Pictorial Presentation

	Aural-Verbal Presentation		
Visual-Pictorial Presentation	Standard	Elaborated	M
Standard	17.06	17.13	17.10
Elaborated	17.56	17.56	17.56
M	17.31	17.35	

Note: MS_e (56) = 1.59

Table 6

Experiment 2: Mean Loss Scores as a Function of Aural-Verbal and Visual-Pictorial Presentation

	Aural-Verbal Presentation		
Visual-Pictorial Presentation	Standard	Elaborated	M
Standard	4.77	4.85	4.81
Elaborated	3.23	4.94	4.09
M	4.00	4.90	

Note: MS_e (56) = 26.17